Pension system design and intergenerational redistribution: applying the Musgrave's rule in a comparative setting

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Abstract

This paper focusses on intergenerational distribution of risk and burden of pension financing in differing pension systems. We apply the Musgrave rule of intergenerational fairness which proposes a pension system to be fair across generations when the system produces a fixed ratio of pensions and labour earnings. By comparing pension system design and financing of pension provision in eight European countries, we assess the effects of the institutional set-up of pension systems on intergenerational redistribution. We assess the key features of the pension systems, their financing as well as reform trends affecting intergenerational fairness in recent years. By including both statutory and occupational pension schemes in our analysis, we extend the Musgrave framework to cover the most relevant schemes for pension provision.

The pension systems address intergenerationally fair redistribution to varying degrees depending on their design as defined benefit (DB) or defined contribution (DC) schemes and the mixture of statutory and occupational schemes. Current trend in pension design implies less intergenerational risk sharing within the pension system and less redistribution from workers to retirees. Our results shows that current retirees are rather well protected. The contribution burden caused by demographic ageing and

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growth in pension expenditure is not straightly forwarded to current employees, but tax financing gains in importance in many countries.

Keywords: intergenerational redistribution, pensions, pension system, Musgrave rule, pension contribution, pay-as-you-go system, ageing, pension reform

1 Introduction

Pension systems are one of the main components of any European welfare state. Pension insurance forms the lion's share of social insurance expenditure, and it is financed through a variety of mechanisms that differ across countries, combining both public and private actors. Their financing touches upon the very core of the welfare state as boundaries between adequacy, sustainability, equality, solidarity and intergenerational equity need to be addressed. Thus, pension systems are being constantly debated both at the national and European level by a variety of actors that have vested interests in these issues (see e.g. European Commission 2012). As European societies are ageing, the pension systems are of increasing interest in the years to come.

Recent pension reforms have typically tried to curb expenditure in near or mid-term future in order to achieve sustainability in the face of population ageing. Along with increases in the retirement age most pension reforms in the EU have reduced benefit ratios for younger generations (see e.g. Hüttl et al. 2015; European Commission 2009; 2015). Pension systems are intrinsically solidary and redistribute wealth across and between generations. However, the ageing of population challenges the intergenerational solidarity as fewer and fewer working age people have to come up with financing the pensions of a growing number of retirees in pay-as-you-go (PAYGO) systems. This development, together with the recent reforms, may challenge the very principles of pension systems.

Furthermore, developments in European labour markets disadvantage younger generations' future pension adequacy compared to older generations. Even though variance between the EU countries does

exist, one of the biggest legacies of the financial crisis since 2008 is high youth unemployment (Eichhorst et al. 2014). While employment rates of older workers have been more resilient since the crisis, young people are experiencing problems in getting attached to the working life (see Eichhorst et al. 2014; Eurostat 2017). This poses further challenges to an adequate replacement ratio even beyond the demographic ageing.

The design of pension system together with labour market attachment have a decisive impact on intergenerational redistribution and future pension levels. For example Grech (2015) and Augusztinovics (2002) state that negative labour market developments and the increase of youth unemployment together with the tightening link between pension entitlements and contributory records introduced by the recent reforms could pose serious risks for current young generations in terms of their future retirement income.

In this paper, we assess how European pension systems adapt to the challenges of ageing and productivity described above with regard to intergenerational redistribution effects. We apply the Musgrave rule of intergenerational fairness (Musgrave 1981), according to which the ratio of pensions over labour earnings net of pension contributions should remain constant. In contrast to the original application of the rule, which only included statutory pension provision, we include both the first pillar statutory and the second pillar occupational pension schemes. We assess how the two critical features, productivity development (i.e., the ratio of wage rate of the working population to the past wage rates of retirees) and population development (i.e., the ratio of working generation to retiree generation) are likely to challenge intergenerational redistribution and fairness in differing pension systems. By comparing the pension system design and how the burden of pension financing is shared between generations in a selection of European countries, we thus provide a more comprehensive picture of redistribution of risk across generations.

We then apply the Musgrave rule for assessing how pension system design theoretically affects intergenerational redistribution under challenges of productivity growth and demographic ageing in eight

European welfare states.[2] In the fourth section, we provide novel empirical evidence on the actual distribution of the financial burden of pension provision and how this challenges intergenerational redistribution from the perspective of the Musgrave rule. We conclude by discussing the feasibility of the Musgrave framework in assessing current pension systems and their intergenerational distribution effects.

2 Pension systems and intergenerational redistribution

2.1 Fairness, redistribution and pensions

Pension systems can be understood as insurance arrangements against a variety of risks (longevity, disability and a loss of spouse/parent) in which pension systems' members pool their savings together to offer an insurance against these risks. In other words, the members share risks with each other. In addition of offering a mere insurance, public pension systems have objectives such as poverty alleviation and redistribution. (Barr & Diamond 2006)

Redistribution of pension systems can be both intra-generational and intergenerational. Intra-generational redistribution exists in the form of e.g. minimum pensions, computation of non-contributory periods, calculation basis and pension ceilings. Intergenerational redistribution comes through the fact that most of the pension provision is financed through the pay-as-you-go mechanism where the working age population finances the pension of the retirees. As generational cohorts differ in size and systems are reformed, redistribution between generations does happen.

In order to share more evenly the costs of ageing and pension provision among the generations, countries have introduced both systemic and parametric reforms in their pension systems. Also, the importance of funded private supplementary occupational pensions is increasing. Another tool to address intergenerational redistribution is automatic stabilizers that are automatically triggering measures to

[2] If a country has different regimes for private sector workers, civil servants and self-employed, our focus in this paper is on the system for private sector workers.

control the expenditure of a pension system. Depending on their design, automatic stabilizers can defend the interests of future generations in the face of population ageing by scaling back pension promises.

An important aspect in the intergenerational redistribution is the pension contribution rate. If the contribution rate is higher for one generation but the benefit is not, wealth is redistributed from one generation to another. Queisser and Whitehouse (2006) describe an actuarially fair pension system as one that equalises lifetime individual pension entitlements to lifetime individual pension contributions. By definition, therefore, there is no redistribution towards or away from any individual. Some countries have sought to move into this direction by reforming their pension systems into defined contribution (DC).

However, looking solely at the contribution rate might be a bit misleading. Pension systems need new contributors and therefore persons with children could be understood as having contributed to the pension system "in nature" (Gosseries 2005). Also, the State's role should be analysed as it can strengthen the financing of the pension system by targeting tax money to the system. Unlike contributions that are paid by the employed and employers, taxes are paid by the whole population including retirees, thus sharing the burden more evenly across generations.

Although pension systems' impact on labour markets falls out of the scope of this paper, it is important to acknowledge that high pension contribution rates might hinder the employment of young people. Similarly, high public pension spending might limit the scope of other state welfare programs such as early childhood or active labour market policies due to scarce resources.

2.2 Intergenerational redistribution and fairness according to the Musgrave rule

The focus of this study is on pension system design, in particular its financing structure and intergenerational redistribution. To be able to assess the intergenerational fairness of pension policy in this context, we apply the Musgrave rule (1981) on risk sharing between different generations. The Musgrave rule provides a useful framework and workable criterion for revealing differences in cross-country comparisons of pension institutions. It has also been widely referred as a rule-of-thumb when discussing the change in the ratio of pension contributions and retiree's benefits and challenges in keeping these in balance in the face of demographic and economic pressures (see e.g. Myles 2002; Schokkaert and Van Parijs 2003; Schokkaert et al. 2017).

In its simplest form, the Musgrave rule states that a pension system is intergenerationally fair, if the ratio of per capita benefits to retirees to per capita earnings of workers (net of social security tax) is fixed (Musgrave 1981: 109). With other words, the relative economic positions of retirees and the working population should remain unaffected of demographic or economic developments. At the system level, this goal can be reached to different degrees with different institutional manifestations of intergenerational distribution of risk. Musgrave divides pension systems in two main categories: in a fully funded system, each generation finances its own retirement and no intergenerational redistribution or contract is needed. In a PAYGO-system, in contrast, "each working generation assumes the responsibility of supporting its retirees while being assured of similar treatment by the next working generation", thus resting upon an intergenerational contract of risk-sharing (Musgrave 1981: 104). The PAYGO systems can, in turn, be divided further into five sub-categories according to the form of the intergenerational contract: i) *ad hoc provision*, ii) *fixed replacement rate* (FRR), iii) *fixed contribution rate* (FCR), iv) *fixed replacement rate, adjusted* (FRRA), and v) *fixed relative position* (FRP) (ibid.). The type of pension system plays a decisive role when determining how macro-level changes such as

changes in aggregate productivity or the relative numbers of workers and retirees, i.e. the dependency ratio, affect risk-sharing and redistribution between generations.

The Musgrave-framework is based on the simplification that the population within a country in a given moment is divided into retirees and employees, and their ratio is defined as the dependency ratio. The framework has two exogenous "shock" variables: productivity and population. The first contingency is that of increasing *productivity*, which Musgrave defines as a situation where the wage rate of the working population exceeds the past wage rate of retirees (Musgrave 1981: 106). For pension systems with different designs, this means differing outcomes. Increase in productivity usually means less pressure to increase contributions.

In theory, higher productivity could compensate the second key contingency, that is, demographic shift. Musgrave defines *population growth* as a situation where the ratio of worker to retirees rises (Musgrave 1981: 107). Demographic ageing challenges population growth quite drastically in many countries, as fertility rates decline and longevity increases. Consequently, increasing dependency ratio puts severe pressure on intergenerational fairness in cost- and risk-sharing.

In the face of demographic, financial and macro-economic shocks, such as ageing or changes in the employment rate, pension systems have different methods of adaptation. These methods include, for instance, changing the contribution rates or the level of pension benefits. Depending on the system, only some of the methods are applicable. So, for instance, with a defined contribution (DC) system, the contribution rate is fixed which means that the system balances itself by adjusting the benefits. In the case of (pure) defined benefit system (DB), the adjusting factor is, on the contrary, the contribution rate while the pension benefit remains untouched. These risk adjustment mechanisms have different effects on different generations involved in the pension system. This deficient risk-sharing with pure DB or DC systems is, according to Musgrave (1981), unacceptable and unfair, and as a result, the systems are politically unsustainable under conditions of population ageing (and economic shocks). Moreover, according to the Musgrave rule of intergenerational fairness in pension systems, the (unexpected)

risks that affect the pension system should be shared between the generations in a way that evens out the negative effects and provides for the fixed relative position of retirees and working population.

The Musgrave rule has some limitations, too. First, the Musgrave rule says nothing about what the relative position of retirees to workers should be. It simply provides a rule for allocating the costs of an unexpected change between generations once an acceptable ratio is established (Myles 2002). Schokkaert et al. (2017) also criticize the rule as an incomplete answer to the challenges of intergenerational equity and of intergenerational risk sharing: Firstly, while it indicates how the risk of demographic changes has to be borne by different generations, it does not resolve the problem of the correct level of pensions to wages. Secondly, it remains silent about the age of retirement for which the Musgrave ratio should be stabilized. As an amendment to the Musgrave rule, Schokkaert et al. (2017) propose that the promise made to the young generations should be a conditional promise: their pension, as a proportion of the labour earnings of the active population, is only guaranteed under the condition that they adjust their retirement behavior along increasing life expectancy (see also Birnbaum et al. 2017).

It should also be noticed that these considerations apply strictly only to pay-as-you-go systems. The intergenerational risk-sharing mechanisms are different within funded schemes. In the case of a funded DC scheme based on individual accounts, the retirement benefit of a worker is equivalent to the capital accumulated by his/her own contributions adjusted to his/her life-expectancy at retirement. These schemes are therefore intrinsically unable to achieve intergenerational risk sharing. However, within funded DB schemes, the intergenerational risk-sharing mechanism is similar to that of the pay-as-you-go DB schemes with increasing longevity leading to increased liabilities and ultimately increased contribution rates without affecting the pension benefit levels, although they are less vulnerable to increases in dependency ratios (Schokkaert & van Paris 2003). Furthermore, the Musgrave rule is easier to apply for government-dominated pension system, but less so for systems where private occupational and individual accounts proliferate (Esping-Andersen and Myles 2006).

3 Pension system design and intergenerational redistribution in eight European countries

3.1 Differing institutional design

The Musgrave framework serves as a conceptual basis for the following analysis of how pension systems differ with regard to the risk sharing between the working population and the retirees. We include eight European countries – Austria, Denmark, Finland, France, Germany, the Netherlands, Sweden and Switzerland – in our analysis, representing different welfare regimes or social insurance models and applying different institutional solutions in their pension systems. They thus represent pension systems with (potentially) different intergenerational redistribution effects.

Pension systems differ by their design and are shaped by culture and institutions. Approaches to intergenerational fairness and risk mitigation are closely related to overall design choices. Issues such as the role and design of the public and private pension system, DB or DC schemes, funding or PAYGO and other characteristics of a pension system play a crucial role (see e.g. Kruse et al. 1997; Kruse 2000; Sørensen et. al 2016). Musgrave's original focus is on public pensions, but pension provision in most of the European welfare states is a varying mixture of public and private schemes. Therefore, intergenerational fairness should be evaluated against the framework of overall pension provision, as we have done in this paper.

In this study, we investigate public first pillar schemes and occupational second pillar schemes. We exclude private pension saving, third pillar schemes, from the scope of our study. They do not directly produce intergenerational risk sharing due to their individualized nature, although they might if there are heavy tax incentives to support these products.[3] By occupational pensions we refer to pension arrangements that are traditionally negotiated between labour market parties who decide on the crucial

[3] The choice of the public–private mix has in general strong implications for the issue of intergenerational risk sharing. However, from an intergenerational perspective, the public-private mix in pension schemes is not an issue per sé, if appropriate regulation obliges the collectively privately funded schemes to integrate an intergeneration risk sharing element in their set-up (Schokkaert and Van Parijs 2003).

aspects of the system. By public pensions we refer to pensions that are statutory and usually involve parliamentary decisions with respect to major changes to the system. By using this categorization we can roughly divide countries in two groups: single pillar and multipillar countries. Our division of countries is based on contribution incomes and coverage of employees in collective occupational pension schemes and the data are taken from a recent study (Vidlund et al. 2016).

The importance of occupational pensions varies when focus is on aggregate level of contribution incomes (Figure 1). Occupational pensions are significant in Denmark and the Netherlands, which are prototypical Beveridgean countries, and where public pension provides universal flat rate pension. They are of significant importance also in Switzerland where, despite of being earnings-related, first pillar pension scheme provides in practice only flat rate benefits to all whether they work or not. In Sweden and France the role of occupational pensions is to complement earnings-related public benefits.

Figure 1 about here

In Austria and Finland, the scope and generosity of statutory pensions have left little room for the development of occupational pensions. Also Germany belongs to the same group although the role of statutory pension is diminishing and it has been projected that occupational pensions will grow in importance. .

In the multipillar countries of our sample occupational schemes cover around 90 percent of employees. In Switzerland and France occupational pension schemes are mandatory. In Sweden, Denmark and Netherlands the occupational schemes are not mandatory, but in reality, they are part of collective labour agreements and therefore most often *de facto* mandatory arrangements.

3.2 Distribution of risk between working age population and retirees

While Musgrave's approach is a theoretical one with highly stylized pension system characteristics, it gives us a good method and a starting point for analysing the more intricate and complex pension systems of today in terms of distribution of risks between the generations. Therefore, following Musgrave's logic, we assess how these macro-level economic and demographic shocks affect workers and retirees in a selection of European countries that have different features of intergenerational redistribution in their pension systems.[4] More specifically, with every country we have included the main private sector's statutory and occupational pension system. This helps us to understand the total intergenerational aspects of the pension provision. However, as was stated in the previous section, in Austria, Germany and Finland the role of occupational pension provision is of minor importance and in these cases, we have only analysed the statutory schemes. As regards the direction of the macro-level shocks, we have assumed an increasing dependency ratio, in which the share of retirees rises due to, among other things, ageing.[5] In addition, we assume an increasing productivity and therefore increasing wages.

Table 1 indicates the corresponding direction of the change (if any) in pension contribution rate (A), benefit per retiree (B), average wages (net of pension contributions) (C) and the resulting benefit ratio (B/C) in statutory and occupational schemes when the dependency ratio and productivity rises. The change in the benefit ratio thus indicates the corresponding intergenerational effect, i.e. which group stands to benefit or lose because of increasing wages or dependency ratio. A positive benefit ratio implies that the retirees benefit from the change and correspondingly a negative ratio implies an improvement in the relative position of the working generation.

Table 1 about here

[4] Our analysis focuses purely on the pension systems and therefore we exclude from our assessment the impact of the decline in employment or wage sum might have on the overall economy where the pension system operates.
[5] This corresponds to Musgrave's concept of population growth.

Increasing productivity

Looking at how the systems react to increasing productivity and constant dependency ratio, the mechanism is quite straightforward with countries where the pension provision is concentrated in the statutory schemes, i.e. Austria, Germany and Finland. The rise in wages should result in lowered contribution rates in Austria and Finland, as the systems are of the DB-PAYGO –type and the indexation mechanism does not transfer wage increases to the benefits.[6] As Germany resembles Musgraves's FRRA-type plan with benefits increased along wages, the contribution rate remains constant in this case. The total result (benefit ratio) is negative with Austria and Finland, which means the workers being those who benefit from the increasing productivity. In Germany, the total result remains constant and the workers as well as the beneficiaries benefit from increasing productivity.

Countries where the provision rests on both the statutory and occupational schemes, the results are somewhat more complicated. In the Netherlands, Denmark, Switzerland and Sweden, the rising productivity does not influence the statutory schemes' contribution rates, albeit the mechanism varies between the countries. As these schemes are DB-PAYGO schemes (we consider national pension schemes as DB schemes) except for Sweden, with full or partial wage indexation, the contribution rate and the benefit ratio remains constant in most cases with both parties benefitting from increasing productivity.

In Sweden, the statutory system is of the NDC-type (FCR) and with the contribution rate fixed, the rising wages result in increased net wages for workers and increased benefits for retirees, although with a lesser amount due to the indexation mechanism not taking wage increases fully into account (wage development reduced by a fixed rate 1.6 p.p.). Therefore, the total result favours the workers as the benefit ratio is negative.

[6] In Finland, the indexation mechanism includes a 20 per cent weight on the development of wages but for our purposes, we consider it entirely as price-, not wage-index.

With multi-pillar countries we must take into account the occupational pension provision in order to grasp the total effects of increasing productivity. As occupational pensions are in general becoming increasingly fully funded DC plans, intergenerational redistribution is weakened. With the exception of France and the Netherlands, second pillar pensions in our comparison are also mostly (in Sweden, Switzerland) or entirely (Denmark) based on DC plans and as such, this is also how they are work in Table 1 above.

In Sweden, where both the statutory and occupational pensions are tightly linked to contributions, the schemes work in the same direction by strengthening the relative position of workers in times of rising productivity. That is, rising wages result in equal rise in the net wage while the pension benefits are adjusted only partly in the statutory scheme and within the occupational schemes they remain as they are. As a result, the risk sharing and mitigation capacities of the Swedish pension system have been reduced (see e.g. Sørensen et al.2016).[7]

The Swedish system is in a clear contrast to Denmark, where the difference between the statutory and occupational schemes mitigates the effects of the rising productivity on the aggregate level. As emphasized by Sørensen et al. (2016) the design of Danish overall pension provision can now be situated somewhere along the continuum between redistributive basic pension and DC.

The situation is different in the Netherlands, where the occupational schemes are still mostly DB-schemes (with some DC-characteristics). However, although the statutory scheme is also DB, their financing methods are different as the occupational schemes are fully funded while the statutory scheme is purely a PAYGO-scheme. This means that, in contrast to the statutory scheme, the contributions in occupational schemes are used to finance the liabilities of the same working generation that pay the contributions. The benefits in the Dutch pension funds are also usually linked to the funding status and

[7] This has also raised questions whether the intergenerational risk-sharing via guaranteed pension is sufficient (Barr 2013).

only secondarily to the development of wages.[8] Therefore, the result is that increasing productivity does not influence the contribution rate in the occupational schemes nor in the statutory scheme. The benefit ratio is therefore negative as the workers benefit from increasing wages through the constant contribution rate. Taking into account of the statutory scheme's constant benefit ratio, the total pension provision slightly favours the workers in times of rising productivity.

In France, the statutory pension is a PAYGO-scheme with defined benefits, thus, in theory, gains in productivity could decrease contribution rate, and, on the other hand, the cost of increasing dependency ratio is borne by the working population.

The occupational pension schemes (Agirc & Arrco) were designed as fixed contribution schemes. The schemes are PAYGO with points based benefits. Theoretically, both pensioners and working age population share the profit if productivity increases, and on the other hand they share equally the weakening position if dependency ratio increases. However, social partners, as plan administrators, have the discretion to adjust or increase contributions to improve the financial situation of the system (Myles 2002). This has led to the situation in which the level of contributions has been increased to avoid reducing benefits (Moore 2001). Since 2013 part of the decrease in productivity has been transferred to pensioners as the revaluation of points has been weakened to follow consumer price index or lower, though (ibid.).

Increasing dependency ratio

Under the increasing dependency ratio and constant productivity contingency, all the countries except Sweden face pressure on increasing public pension contributions and therefore, improvement in the

[8] For example, the largest occupational scheme, the public sector's ABP, has not indexed pensions since 2009 due to the funding status remaining under the indexation threshold. At the same time, the applicable wages have grown almost every year (see abp.nl).

relative position of retirees. The occupational schemes, on the contrary, usually serve to mitigate this effect.

In Sweden, the contribution rate does not react to ageing population because of the NDC (FCR) character of the system, but the benefit level does - in effect placing the burden on the retired generation. This means that the intergenerational mechanism favours the workers, as the benefit ratio is negative. The situation is, however, different within the occupational schemes. As these are mostly fully funded DC schemes, the increasing dependency ratio does not affect the contribution or benefit levels and the benefit ratio remains constant. Overall, the adverse effects on the retirees in the statutory scheme are somewhat mitigated by the occupational schemes.

Also in Germany, the pressure shifts to retirees but only by a reduced amount. The contribution rate is adjusted along the developments in the insured wage sum and pension expenditure, and so it rises as the dependency ratio increases, but the indexation mechanism through the so called sustainability factor takes into account the change in the relative numbers of insured and beneficiaries mitigating the ageing effect. Through this mechanism, the additional financial burden resulting from the demographic shift is placed on the beneficiaries, but only with a 25 per cent weight. This means that the system places greater demands on the contribution rate and today's younger generation than on the adjustment of the pension level. However, while the benefit ratio remains positive, i.e. favouring retirees, the indexation mechanism together with the rising retirement age reduces the need to adjust the contribution rate when the dependency ratio weakens (see e.g. Börsch-Supan et al. 2003; 2007.).

Similarly to Germany, the Finnish system shifts some of the burden of increasing dependency ratio to (new) retirees by applying the life expectancy coefficient to the new benefits. Instead of working through the indexation mechanism, the coefficient reduces the amounts of starting monthly benefits if there is an increase in the life expectancy. It should be noted that this mechanism does not take into account of the change in the dependency ratio through different cohort sizes, as is the case in Germany,

and also, as it only reduces the new benefits, its effect is limited on the aggregate contribution and benefit rates. In addition to the life expectancy coefficient, the retirement age will be linked to life expectancy after 2027 with the effect of reducing the contribution burden in the future. Overall, the Finnish system behaves more like a traditional DB-PAYGO system, and in an increasing dependency ratio environment, it is the working generation that bears most of the burden with a positive benefit ratio sign in the table.

In Switzerland and Denmark, the statutory schemes adjust to increasing dependency ratio by increasing the contribution rates while leaving the benefit levels unaffected, thereby strengthening the relative position of the retirees. However, as the occupational schemes are of the DC-type, they play, similarly to Sweden, a mitigating role leaving the contribution rate and the benefit levels unaffected for their part. Overall, the benefit ratio slightly favours the retirees when taking into account the statutory and occupational schemes.

In the Netherlands, the increasing dependency ratio results in an increased contribution rate for the working generation in the statutory scheme while leaving the benefits unaffected, thus favouring the retirees. The occupational schemes, however, slightly mitigate this effect. Even though the occupational schemes are of the DB type, the contribution rate is affected by the increasing dependency ratio only in as much as the change in the ratio is due to an increase in life expectancy. If the change is due to different sized cohorts, the contribution rates remain mostly as they are because the working generations primarily finance their own benefits through pre-funding. Overall, the Dutch pension system favours the retiree generation in times of increasing dependency ratio, as the benefit ratios are positive for the statutory system and zero or positive for the occupational schemes.

3.3 Development of pension financing and intergenerational redistribution

The challenging demographic circumstances for the pension systems should have resulted in increased public pension contributions for almost all the countries in our comparison as shown in previous section. However, it appears that increase in contribution rates is no longer as feasible an option as it may have been some decades ago. The recent development in the contributions levied from employees and employers verifies this finding (Figure 2; see also OECD 2007; 2011). For example, in Austria and Switzerland, the contribution rate has stayed at its current level for close to 30 years. Overall, it seems that a ceiling for public contribution rates has been reached in many countries.

Figure 2 about here

Constant contribution rates would be an easily explained phenomenon if the schemes were DC schemes with fixed contribution rates like in Sweden since 2000. However, public schemes are DB schemes in principle adjustable pension contribution rates. Despite DB type schemes, countries have limited contribution development. In the Netherlands, the government decided to cap the contribution rate already in 1997. Likewise, in Germany, a ceiling for the contribution rate was imposed by an act in 2002 with the passing of the Riester reform. In Finland, projections for recently established pension reform indicate a stable contribution rate for the forthcoming decades (Tikanmäki et al. 2016).

Limited contribution rates with DB schemes would imply adjusted benefit levels in order to control for the adverse effects of ageing. This would mean that the additional burden would have fallen on the retirees. As can be seen from the Figure 3 below, this has not been the case, however, even though adjustments to future benefits have decreased the need to increase the contributions.

Figure 3 about here

A closer look at the financing structure reveals that the public contribution rate is not a sufficient indicator for describing the total costs and the distribution of the burden of pension provision. If we ignore tax revenues as well as contributions into occupational pension schemes, we also miss important elements affecting intergenerational redistribution.[9] Depending on the country, tax revenues cover a significant share of total costs and similarly occupational pensions have a large role in pension provision with a substantial share of pension contributions (Figure 4). The higher the share of occupational pensions, the more limited is the scope for intergenerational risk sharing, presuming they are DC, as in most cases they are.

Figure 4 about here

The role of tax financing is significant in several countries depending on the structure of pension provision. Usually it is connected to financing minimum pensions, as is the case with national pension scheme in Denmark. However, the importance of tax or general budget financing is also evident in Austria where the additional financing needs for the general pension scheme will have to be met through higher government participation (Knell 2005).

Some of the countries have increased the use of tax revenues in pension financing. For example, in Germany the State's share amounted close to 20 per cent of the total public pension expenditure in 1991 reaching over 30 per cent in 2014 (DRV Bund 2015). In Germany the federal transfers (Bundesmittel) are used to cover the pension costs arising from the German reunification as well as unpaid periods (BMAS 2016). The purpose is also to limit increase in labour costs, which is also the case in Switzerland (IMF 2001).

[9] Furthermore, the use of reserve or buffer funds reduces the need to collect more taxes or to raise contributions as well as the need to cut benefits.

Use of tax revenues in the financing of pensions provides a measure for reallocating the costs not only among the working-age populations but also among the retired. Changes in financing may influence the intergenerational equity, e.g. taxes are also paid by pensioners thus increasing risk sharing. In the Netherlands, the share of taxation has increased significantly after capping the contribution rate. Since the turn of the millennium, State's share has increased from around one tenth close to one third of the public expenditure. Several committees and political parties have even suggested further increases in order to broaden the base for statutory pension financing, to include the elderly (Goudswaard et al. 2015).

4 Discussion and conclusion

In this paper, we assessed key features of pension systems and their change affecting intergenerational redistribution and fairness in eight European welfare states. According to the Musgrave rule, the risk of pension provision securing old-age income should be allocated evenly between the generations and in an ideal case, the relative position should remain constant. Musgrave's approach is a conceptual one and does not recommend an "ideal" model for a pension system. A fair system according to Musgrave's principles would be an intermediate solution in-between the DB and DC rules which appropriately adjusts the benefit levels and contribution rates in the face of economic and demographic risks.

We extended Musgrave's original framework to include overall pension provision, which in many countries consist of both public and occupational pension schemes. Our results show that countries' pension systems have currently different ways to distribute the consequences of gains in productivity or increase in the dependency ratio between pensioners and workers.

In public pensions, half of the countries (Denmark, the Netherlands, Switzerland, Germany) split the gains in productivity evenly between workers and pensioners. This is due to indexation rules linking

benefits to wages. In rest of the countries (Sweden, France, Austria, Finland) pensioners lose in comparison to workers. Of these countries, pensions are not indexed to wages except in Sweden, where despite the partial link to wages, workers benefit the most as a result of the NDC system with fixed contribution rate. When taking into account occupational pensions the relative position of pensioners declines. Overall, the position of a pensioner depends on the relative amount of the public and occupational pensions in his or her total pension. Therefore, for instance a pensioner with only public pension in the Netherlands, Denmark and Switzerland benefits the most from rising wages, whereas a pensioner with a high share of occupational pension benefits relatively less.

Regarding population ageing and public pensions, only in Sweden the relative position of the pensioner compared to the average worker is weakened because of the NDC system placing the burden on retirees. Also in Germany pressure of ageing is transferred to pensioners but only to a limited extent. In all the other countries, the relative position of pensioners strengthens, as the contributions should be increased while the benefits are left unadjusted. Occupational pensions are mostly neutral in this respect except the Netherlands where ageing can lead to increased contributions.

One of the key findings of our analysis is that the contribution rates do not strictly follow the growth in pension expenditure as could be assumed on the basis of the analysis above. In many cases the public pension contribution income is not sufficient to cover benefit payments, although countries have implemented reforms that limit the growth of public pension expenditure. For example, Germany, Denmark, Finland and France have met this challenge by increasing the retirement age as well as introducing automatic adjustment mechanisms in a similar manner as the majority of OECD countries (see, for example, OECD 2015).

As we have shown, contribution rates have remained constant for a long period despite increasing expenditures. In Finland and Sweden the deficit can be covered internally, i.e. by the use of funds within the pension system. Other countries have opted for increasing use of tax revenues or even increasing public debt.

However, the use of tax revenues can be seen as a symptom of an underlying unfair structure of pension system. According to Musgrave (1981: 109), DB schemes (FRR or FRRA) are an uneasy and politically unstable option as a basis for a pension scheme especially in an environment of declining population growth. Indeed, the development in the Netherlands' national pension scheme shows that increasing solely the burden of the working population is not seen as a fair option anymore. Instead, tax revenues are increasingly used to maintain the financial sustainability and sharing the costs with the elderly.

Whether increasing use of tax revenues is the best practice for promoting intergenerational fairness is not so clear. Revenue-oriented adjustment may lead to an unwanted intergenerational redistribution, placing the main burden on the younger generations. First, adjustment is limited to the revenue side and may not necessarily translate into any change on the benefit side. Second, the financing will increasingly shift from contributions to taxes decreasing the transparency and the degree of actuarial fairness that is in clear contrast to one of the current reform trends in pension insurance provision.[10] This arrangement, however, implies intergenerational consequences. The exact nature of the intergenerational sharing of this burden is also dependent on which tool — taxation or debt — is used to finance the government's pension transfers (Knell 2005).

We can also observe problems in fairness with intergenerational redistribution at the opposite end of pension design. The problem with pure DC (FCR) system is that it places the entire risk on retirees, which is unacceptable and decreases the political viability of the system according to Musgrave (1981: 104). This seems to be evident for example in Sweden, where the impact of benefit cuts in the public

[10] Actuarial fairness, proposes that it is fair that each risk group pays for their own risks. The concepts of actuarial fairness and the solidarity principle have historically competed in policy making and the weight of these principles differs by schemes and in the overall pension provision depending on the institutional design of pension schemes. There is also empirical evidence (see Schokkaert 2004) that workers and their organizations are more willing to accept a lower net wage as a result of higher taxes if there is an apparent link between contributions and benefits.

scheme has been softened with tax deductions for retirees as well as changes made to indexing or more precisely to balancing mechanism (Anderson & Backhans 2014; Regeringens proposition 2015).

In general, according to system characteristics of the countries reviewed, the pension systems address the intergenerational equity with varying degrees. This is evident in the non-pure nature of the schemes as well as the fact that the total pension package in each country usually includes pensions from different systems, including occupational DB and DC schemes. Current trend in occupational pension design from DB to DC implies less intergenerational risk sharing within the pension system and less redistribution from workers to retirees.

Intergenerational fairness is more on the agenda of today's pension policy. Risks are more evenly distributed across the generations as the schemes are no longer pure DB. However, our results show that current retirees are still rather well protected against demographic ageing. Another observation is that countries that rely on multipillar systems have less scope for risk sharing on aggregate level. Our analysis also shows the constraints of the traditional DB/DC dichotomy as many pension systems are turning towards a hybrid including elements of both.

However, the need to adapt pension schemes to increases in life expectancy remains regardless of the type of schemes in both single and multipillar countries. In order to ensure stable retirement incomes, longer working lives are needed to ensure a decent pension. As Musgrave is only interested on the relative position of retirees and workers an increase in retirement age is equitable from an intergenerational perspective and consistent with the Musgrave rule as it cuts both ways: reducing time in retirement and simultaneously raising contribution years. An issue, which is ignored by Musgrave but discussed in more detailed by Esping-Andersen and Myles (2006), is that it may easily produce intra-generational injustice since life expectancy is positively related to lifetime income.

Another aspect to bear in mind is that challenges of intergenerational redistribution and fairness cannot be mitigated by pension systems alone, as pensions mainly reflect labour market outcomes. The requirement of longer careers for adequate pensions seems difficult to fulfill at the current labour markets for younger cohorts. Although pension systems cannot resolve all the problems resulting from inequalities at the labour market, they can per design mitigate and soften life-course impacts and promote fair intergenerational redistribution to some extent.

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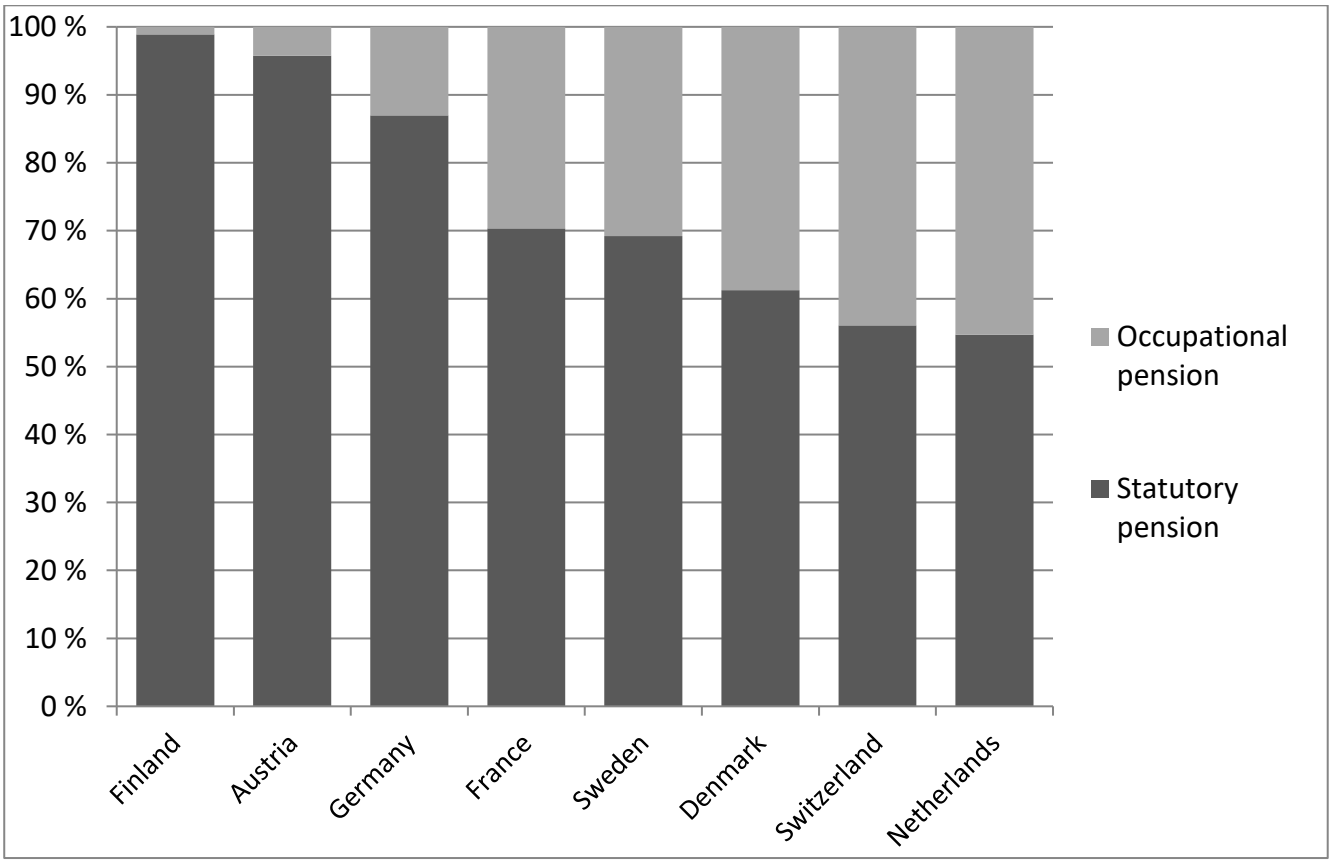
Table 1. Effect of changes in productivity and population in different pension system designs

	Statutory				**Occupational**			
	Contribution rate (A)	Benefit per re-tiree (B)	Net wage per worker (C)	Ratio B/C	Contribution rate (A)	Benefit per re-tiree (B)	Net wage per worker (C)	Ratio B/C
Netherlands								
Increasing productivity	0	+	+	0	0	0	+	-
Increasing dependency ratio	+	0	-	+	0/+	0	0/-	0/+
Sweden								
Increasing productivity	0	0/+	+	-	0	0	+	-
Increasing dependency ratio	0	-	0	-	0	0	0	0
Denmark								
Increasing productivity	0	+	+	0	0	0	+	-
Increasing dependency ratio	+	0	-	+	0	0	0	0
France								
Increasing productivity	-	0	+	-	0	+	+	0
Increasing dependency ratio	+	0	-	+	0	-	-	0
Switzerland								
Increasing productivity	0/-	0/+	0/+	0	0	0	+	-
Increasing dependency ratio	+	0	-	+	0	0	0	0
Austria								
Increasing productivity	-	0	+	-				
Increasing dependency ratio	+	0	-	+				
Germany								
Increasing productivity	0	+	+	0				
Increasing dependency ratio	+	0/-	-	+				
Finland								
Increasing productivity	-	0	+	-				
Increasing dependency ratio	+	0	-	+				

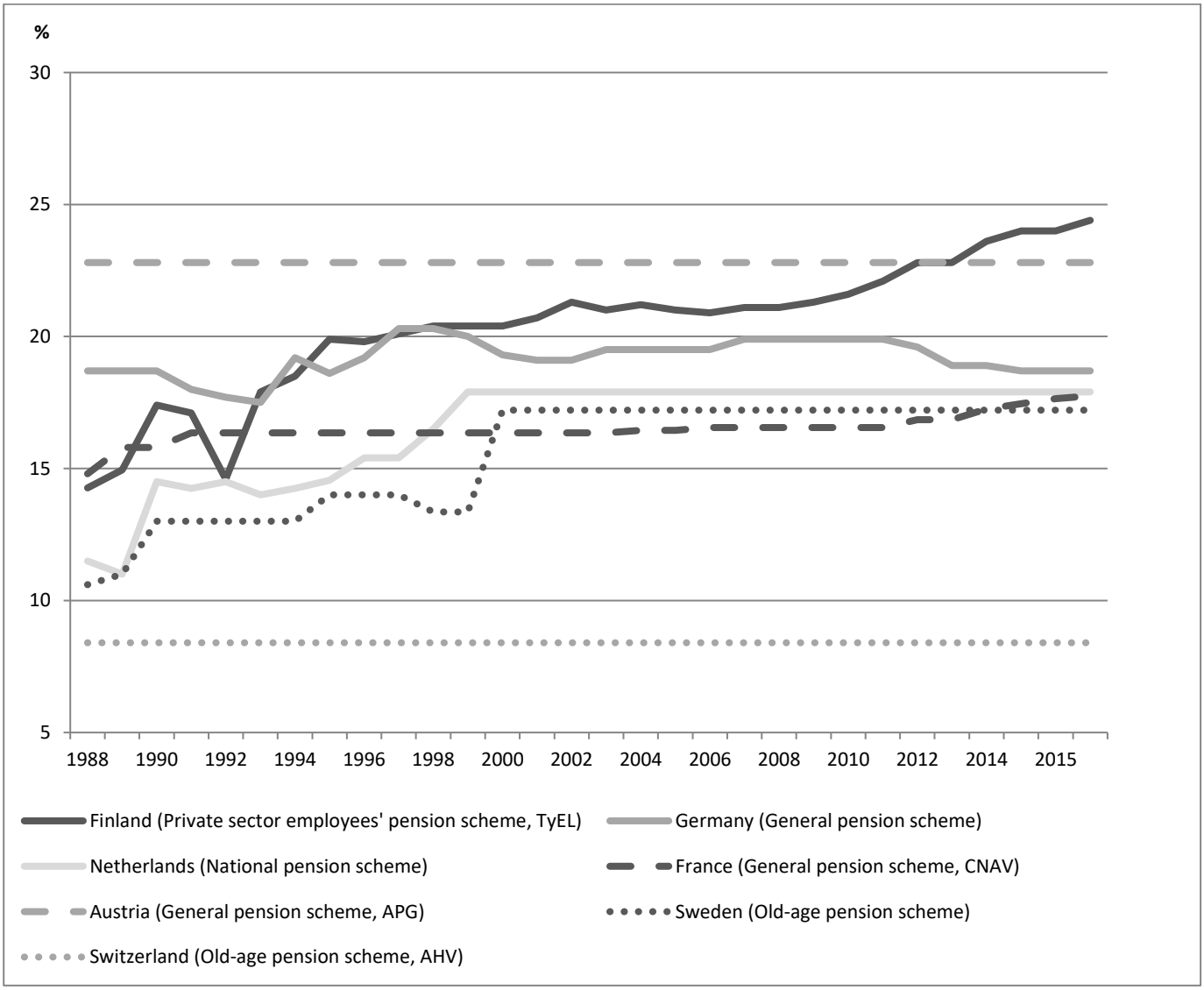
Note: (+) indicates increase, (-) indicates decrease, a zero indicates no change and (/) indicates a partial effect.

Figure 1. Share of occupational and statutory pensions in 2014(% of total contribution income)



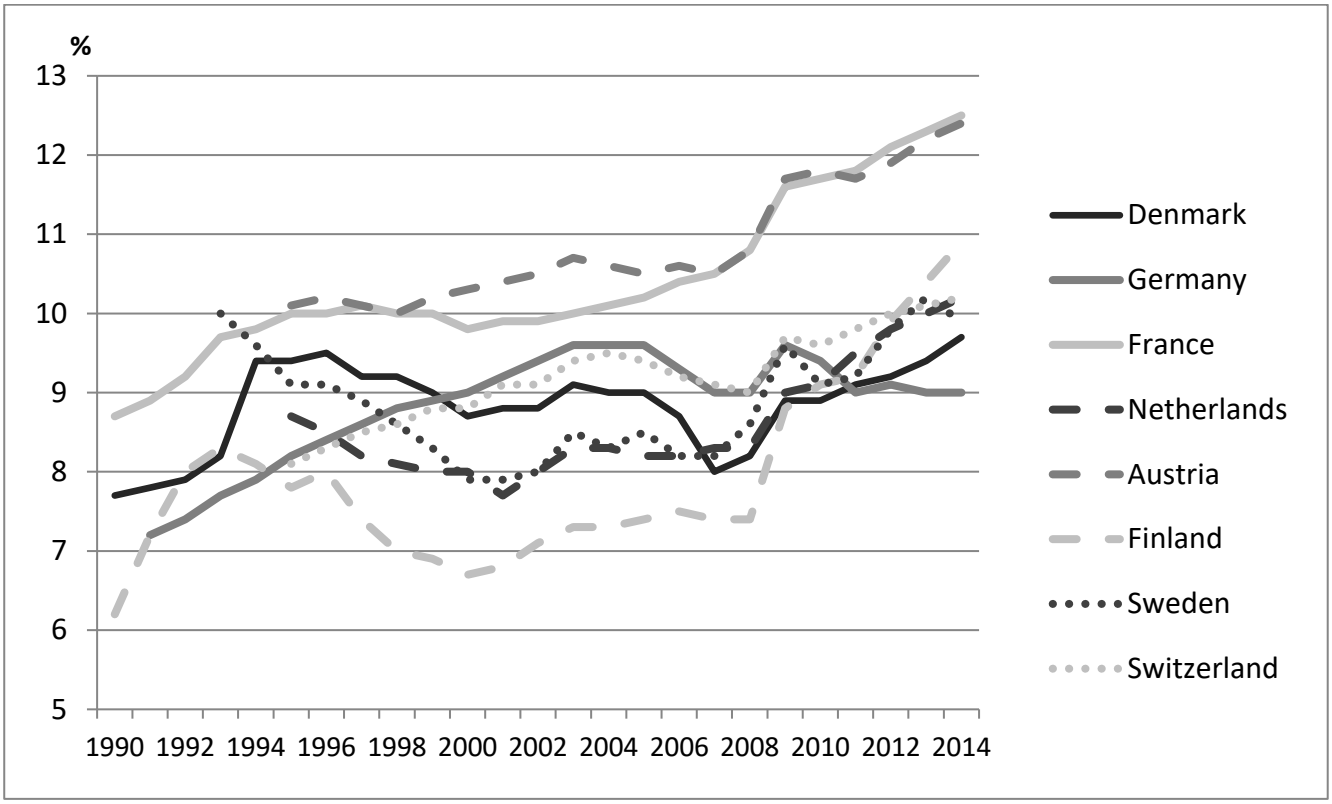
Source: Vidlund et al. 2016.

Figure 2. Public pension contribution rates 1988-2016, %.



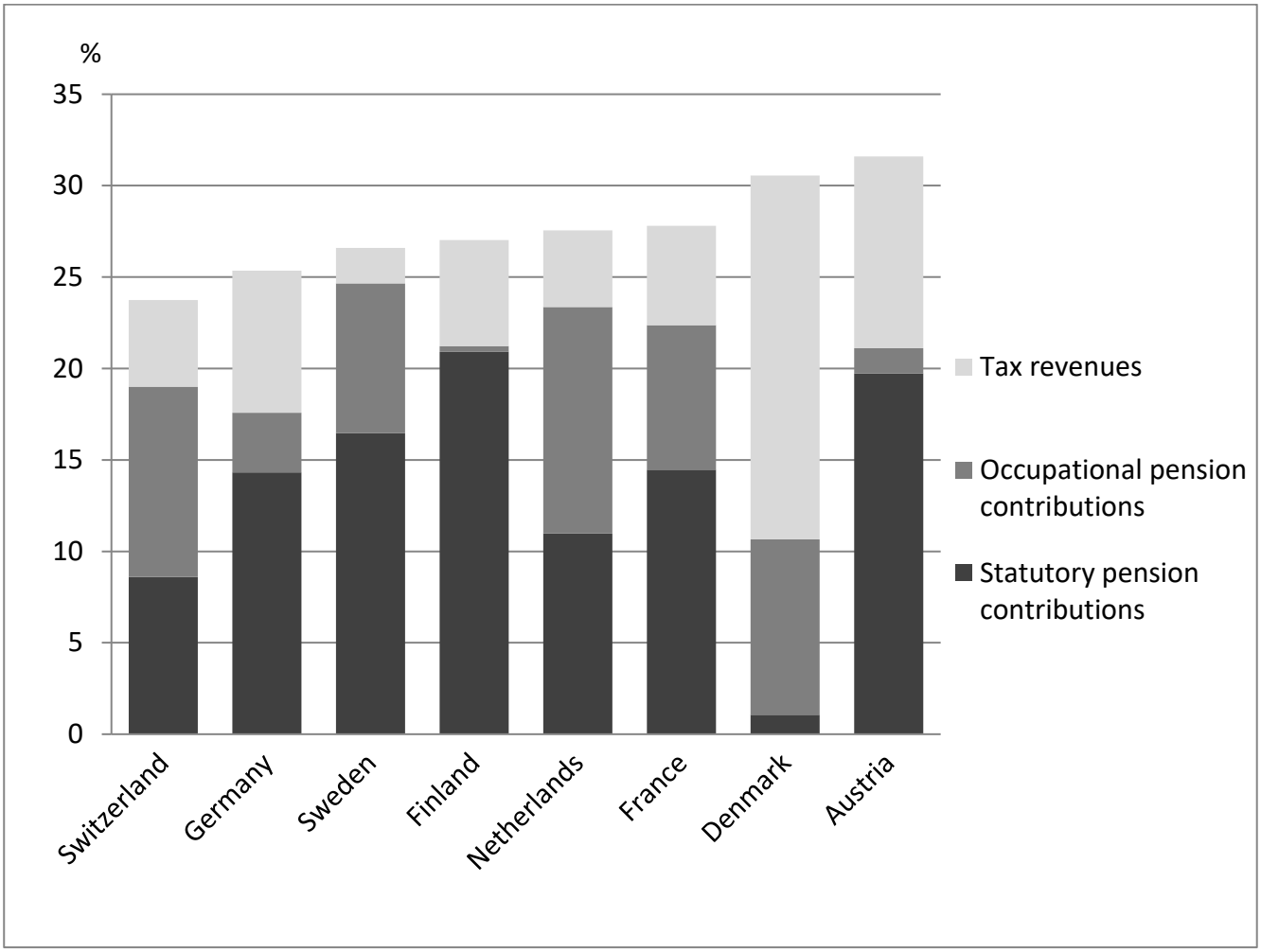
Source: Vidlund et al. 2016.

Figure 3. Development of old-age pension expenditure 1990-2014, % of GDP.



Source: Eurostat 2017.

Figure 4. Total pension contribution income in relation to compensation of employees in 2014, %.



Source: Vidlund et al. 2016.